Long-Term Aquatic Macrophyte Management and Control Plan for PEARLY POND
Rindge, New Hampshire
Cheshire County

Prepared by: New Hampshire Department of Environmental Services (DES),
In cooperation with the
New Hampshire Fish and Game Department (F&G)
February 2008

PROBLEM STATEMENT

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and ponds (Luken & Thieret, 1997, Halstead, 2000). According to the 2006 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM), "exotic macrophytes are non-native, fast growing aquatic plants, which can quickly dominate and choke out native aquatic plant growth in the surface water. Such infestations are in violation of Env-Ws 1703.19, which states that surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region."

Though exotic aquatic plants can negatively impact an aquatic system, native aquatic plants are beneficial to the aquatic ecology of waterbodies. Diverse assemblages of native aquatic plants are a source of oxygen to the system, they provide stabilizing root systems to minimize erosion and turbidity, and they provide food and habitat for aquatic life. The aquatic plant management plan for Forest Lake outlines actions to eradicate variable milfoil (*Myriophyllum heterophyllum*, referred to as "variable milfoil" in this plan) while maintaining native plant communities whenever variable milfoil control actions are being implemented.

It is well documented that exotic aquatic plants pose a threat to water quality and the ecological, aesthetic, recreational, and economic values of lakes and ponds. Though exotic aquatic plants are not favored in an aquatic system, native aquatic plants are beneficial to the aquatic ecology of waterbodies, and as a result, any plans for aquatic plant management will seek to maintain native plant communities and to only control or eradicate exotic aquatic plants in the subject waterbodies.

Variable milfoil (*Myriophyllum heterophyllum*) became established in Pearly Pond in Rindge, New Hampshire in the 1990s. The plant has colonized a large area in the northern end of the lake, and has also established smaller populations in the southern end of two coves, and in the southwestern end of the lake near the dam. Figure 1 illustrates the distribution of variable milfoil infestations in Pearly Pond.

Following is a summary of each area indicated in Figure 1:

Area 1- This is the largest contiguous infested area in the pond. The area covers nearly 40 acres with variable milfoil coverage at the 90% level.

Area 2- This area is slightly less than one acre, and has milfoil coverage at about a 10%.

Area 3- This area is just over 3.5 acres, and has dense variable milfoil growth with approximately 90% cover.

Points- The three individual points near the dam/outlet are either single clumps or individual stems of variable milfoil plants that are rooted and growing in the shallows.

In terms of the impacts of the variable milfoil in the system, there are roughly 42 houses around the shoreline of Pearly Pond, and nine back lots that have access or rights-of-way to the pond. Some houses abut the areas of dense milfoil growth, and a public bathing beach is present along the shoreline of Area 1, which is impaired due to the variable milfoil growth.

Lake residents have recently become more concerned with the variable milfoil growth, and would like to act now before the infestation continues to spread throughout this small pond.

Ecologically, at this time, there are no observed problems with the milfoil, however there is an extensive wetland area with good natural habitat that is being encroached upon by the variable milfoil at the northern end of the pond.

PURPOSE

The purposes of this exotic aquatic plant management and control plan are:

1. To identify the waterbody's beneficial use areas, including essential aquatic habitat, designated conservation zones, swimming areas, boat access sites, and boating use areas;
2. To present the aquatic macrophyte distribution map, including both native and exotic species;
3. To identify short-term and long-term exotic aquatic plant control goals that protect and conserve the lake's beneficial uses;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To recommend monitoring strategies to determine the success of the control practices over time in meeting the goals.

This plan summarizes the current physical, biological, ecological, and chemical components of Pearly Pond and the social and ecological impacts of the infestation. The plan considers the beneficial uses of the pond as well as their spatial distribution, compared with the current status of the exotic plant infestation to formulate a long-term plan for controlling variable milfoil in Pearly Pond.

The intent of this strategic plan is to reduce the overall acreage and percent cover of variable milfoil from Lake Winnisquam over time through the use of Integrated Pest Management Strategies (IPM), and to maintain it at this reduced level of approximately 20% cover in areas prone to variable milfoil growth. Appendix A details the strategies available for waterbodies with exotic species, and provides more information on each of the activities that are recommended within this plan.

GOALS/OBJECTIVES OF MILFOIL CONTROL ACTIONS

The goals for milfoil control in Pearly Pond are:

1) To reduce the overall percent of milfoil bottom growth in Area 1 and 3 from 90% in 2008, with the use of 2,4-D, to less than 20% cover in each area to allow for smaller scale control actions to take place in future years.

2) Following completion of 1 above, maintain variable milfoil infestations to less than 20% in infested areas in Pearly Pond through integrated plant management approaches.

3) To eradicate variable milfoil infestations located at individual points near the outlet and in Area 2 by hand-removal, diver-assisted suction harvesting, and/or benthic barrier placement.

4) To establish a Weed Watcher program for the pond, and a Lake Host Program if a public access site is created/enhanced.

Town Support

The town supports the efforts of the local lake association to control the variable milfoil in Pearly Pond, but has not made financial contributions to the project.

Pearly Pond Lake Association

Many residents around Pearly Pond are concerned about the variable milfoil growth, and are interested in participating in a Weed Watching Program on the lake, to monitor both for expanded growth of the milfoil, and for the possible introduction of any new exotic aquatic plants to the system. DES will perform a Weed Watcher training session on the pond for interested individuals.

Local divers on the pond are interested in participating in the Weed Control Diver course to become certified to hand-remove variable milfoil from the lake as part of the integrated management approach.

Additionally, Franklin Pierce College also holds shorefront property on the pond, and they are concerned about the variable milfoil growth, and could be tied into any projects on the pond.

WATERBODY CHARACTERISTICS

The following table summarizes basic physical and biological characteristics of Pearly Pond.

General Lake Information	
Lake area (acres)	142.1
Watershed area (acres)	2,558.9
Shoreline Uses (residential, forested, agriculture)	Residential, forested, college campus
Max Depth (ft)	17.82
Mean Depth (ft)	5.61

Trophic Status	Eutrophic
Color (CPU) in Epilimnion	92.5
pH	5.5
Clarity (ft)	3.3
Flushing Rate (yr^{-1})	4.4
Natural waterbody/Raised by Damming/Other	Natural with dam
Plant Community Information Relative to Management	
Invasive Plants (Latin name)	*Myriophyllum heterophyllum*
Infested Area (acres)	42.5
Distribution (ringing lake, patchy growth, etc)	Some large and dense patches in lake and in coves. Other areas have single stems of plants or small patches of plants.
Sediment type in infested area (sand/silt/organic/rock)	Silty/organic/rock
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Inventory)	Banded Sunfish- Rare in NH
Area of Littoral Zone (acres)	102
Area of Profundal Zone (acres)	98
Area of Macrophyte Coverage (native or otherwise) of Plants in Littoral Zone	83
% of Littoral Zone with Macrophyte Cover	83
% of Macrophyte cover comprised of invasives	49
% of Littoral Zone with Variable Milfoil Cover	43

An aquatic vegetation map and key from an October 3, 2006 survey by the DES Biology Section is shown in Figure 2. A bathymetric map is shown in Figure 3.

BENEFICIAL (DESIGNATED) USES

In New Hampshire, beneficial (designated) uses of our waterbodies are grouped into five general categories: Aquatic Life, Fish Consumption, Recreation, Drinking Water Supply, and Wildlife (CALM).

Of these, Aquatic Life and Recreation are the ones affected by the presence of variable milfoil.

AQUATIC LIFE

The goal for aquatic life support is to provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region.

WILDLIFE HABITAT EVALUATION (NH F&G DEPARTMENT)

Pearly Pond in Rindge is managed as a warmwater fishery. Most recent fish survey data comes from electrofishing and fyke netting in 1984. The primary gamefish sampled were largemouth bass and chain pickerel. Other species of interest to anglers that were sampled included hornpout, bluegill, and yellow perch. Golden shiners and common white sucker were the baitfish sampled.

This is an excellent largemouth bass fishery and is only accessible to boat anglers with canoes, kayaks, or small jon boats. Angler comments reveal fishing at Pearly Pond to be above average because of good shoreline habitat, lack of disturbances (boats etc.), and lack of easy access. It is one of the best bass ponds in the area and has plenty of baitfish. There are numerous largemouth bass of all size classes and the potential for exceptional sized bass. Anglers report current fishing in the northern cove to be much more difficult than in the past. Figure 4 illustrates the common fishing spots on Pearly Pond.

The New Hampshire Natural Heritage Bureau has a listing of the banded sunfish as being present in Pearly Pond. In terms of impacts of these management practices on this fish species, DES does not anticipate that impacts will be seen as a direct result of the herbicide application. Specifically, for the banded sunfish, which seems to inhabit areas of dense aquatic vegetation, the habitat structure of the pond will not significantly change. Pearly Pond is characterized by stands of dense and diverse native plant communities, including submergent, emergent, and floating species. These will not be impacted by the target-specific herbicide treatment proposed here for the variable milfoil.

PUBLIC USES AND ACCESS POINTS

Pearly Pond is used for numerous recreational activities, including boating, fishing, and swimming by primarily pond residents and students at Franklin Pierce College. Boat traffic is light as the majority of recreational use is from shore-owner boat traffic and kayakers. Figure 5 shows the common boating lanes on the pond.

There is a public ("designated") beach located on the campus of Franklin Pierce College, and a marginal/not well developed public boat access adjacent to the dam. A designated beach is described in the CALM as an area on a waterbody that is operated for bathing, swimming, or other primary water contact by any municipality, governmental subdivision, public or private corporation, partnership, association, or educational institution, open to the public, members, guests, or students whether on a fee or free basis. Env-Wq 1102.14 further defines a designated beach as *"a public bathing place that comprises an area on a water body and associated buildings and equipment, intended or used for bathing, swimming, or other primary water contact purposes. The term includes, but is not limited to, beaches or other swimming areas at hotels, motels, health facilities, water parks, condominium complexes, apartment complexes, youth recreation camps, public parks, and recreational campgrounds or camping parks as defined in RSA 216-I:1, VII. The term does not include any area on a water body which serves 3 or fewer living units and which is used only by the residents of the living units and their guests.*

In addition to the designated beach, there are a number of small private beaches on shorefront properties around the pond, as well as approximately 14 swim platforms and a number of docks. Figure 6 shows the location of swim beaches, swim platforms, and docks on Pearly Pond.

MACROPHYTE HABITAT EVALUATION

The littoral zone is defined as the nearshore areas of a waterbody where sunlight penetrates to the bottom sediments. The littoral zone is typically the zone of rooted macrophyte growth in a waterbody.

The littoral zone of the lake is characterized by a mix of native and non-native (variable milfoil) plant growth (Figure 2). Native species include a mix of floating plants (watershield and yellow and white water lilies), emergent plants (bur-reed, cattail, pickerelweed, rushes, grasses), and submergent plants (pondweeds). Native plant communities are mixed around the entire lake, and are characterized as 'abundant' by the DES.

HISTORICAL CONTROL ACTIVITIES ON PEARLY POND

There have been no exotic aquatic plant control practices previously conducted on Pearly Pond.

VARIABLE MILFOIL MANAGEMENT OPTIONS

The control practices used should be as specific to variable milfoil as feasible. No control of native aquatic plants is intended.

Exotic aquatic plant management relies on a combination of proven methods that control exotic plant infestations, including physical control, chemical control, biological controls (where they exist), and habitat manipulation. Integrated Pest Management Strategies (IPM) are typically implemented using Best Management Practices (BMPs) based on site-specific conditions so as to maximize the long-term effectiveness of control strategies. Descriptions for the control activities are closely modeled after those prescribed by the Aquatic Ecosystem Restoration Foundation (AERF) (2004). This publication can be found online at http://www.aquatics.org/aquatic_bmp.pdf.
Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices used by the State of New Hampshire. DES has evaluated the feasibility of potential control practices on Pearly Pond. The following table summarizes DES' control strategy recommendations for Pearly Pond.

FEASIBILITY EVALUATION FOR CONTROL ALTERNATIVES

Control Method	Use on Pearly Pond
Restricted Use Areas	A Restricted Use Area could be use along the southern boundary of the wetland at the north end of Pearly Pond. This would serve to restrict any access, and thus transport of fragments from this area to the main body of the lake. At the very least, a simple fragment barrier could be erected.
Hand-pulling	DES recommends that the individual stems or small patches of variable milfoil be hand pulled when encountered. The individual

Control Method	Use on Pearly Pond
	points near the outlet are prime for hand-pulling techniques, as are some of the smaller patches in the coves of the pond.
Diver-Assisted Suction Harvesting	DES recommends working with contracted divers who are competent with this management technique to remove variable milfoil growth that may persist or re-grow following the herbicide treatment.
Mechanical Harvesting/Removal	For Pearly Pond, mechanical harvesting is not recommended due to the threat of spreading variable milfoil to uninfested areas of the lake through the generation of fragments.
Benthic Barriers	Benthic barriers should be used in areas where variable milfoil growth is small and patchy, where herbicides are not used, or where herbicides are used and there is minimal regrowth of variable milfoil.
Herbicides	For Pearly Pond, herbicide use is recommended as primary treatment due to extent of infestation. The aquatic herbicide 2,4-D is recommended in 2008 due to the tannic and moderately turbid waters of the pond. With these water quality conditions, the alternative herbicide, Diquat, is not as effective in controlling the milfoil as it quickly binds to the organic material in the water column.
Extended Drawdown	Drawdown is not an effective control method for variable milfoil.
Dredge	Not recommended due to nature of exotic plant distribution, the cost, or the ancillary ecological impacts that the dredge could have.
Biological Control	There are no approved biological controls for variable milfoil at this time in New Hampshire.
No Control	Variable milfoil has been expanding during each growing season in Pearly Pond. Because of the relative shallow nature of the pond, and softer bottom sediments in most locations, variable milfoil has the potential to soon ring the shoreline of the lake. A no control option would allow for this to take place.

EXOTIC AQUATIC PLANT CONTROL PLAN

An evaluation of the size, location, and type of variable milfoil infestation, as well as the waterbody uses was conducted by DES on October 3, 2006. Based on the evaluation, the following control actions are recommended:

Year	Treatment Type	Responsible Party	Schedule
2008	2,4-D treatment of Areas 1 and 3 show in Figure 1	Aquatic Control Technology, Inc.	May/June

Year	Treatment Type	Responsible Party	Schedule
	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Trained Pearly Pond Association divers or contracted divers	June through September
	Installation of benthic barriers, as may be appropriate	DES and Pearly Pond divers	July/August
	Weed Watching and Lake Hosting Activities	Pearly Pond Association and lake residents	June through September
2009	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Trained Pearly Pond Association divers or contracted divers	June through September
	Installation of benthic barriers, as may be appropriate	DES and Pearly Pond divers	July/August
	Weed Watching and Lake Hosting Activities	Pearly Pond Association and lake residents	June through September
	Site Assessment	DES	August/September
2010	Herbicide Treatment, if needed, based of from 2009 DES assessment	TBD	May/June
	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Trained Pearly Pond Association divers or contracted divers	June through September
	Installation of benthic barriers, as may be appropriate	DES and Pearly Pond divers	July/August
	Weed Watching and Lake Hosting Activities	Pearly Pond Association and lake residents	June through September
2011	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Trained Pearly Pond Association divers or contracted divers	June through September
	Installation of benthic barriers, as may be appropriate	DES and Pearly Pond divers	July/August
	Weed Watching and Lake Hosting Activities	Pearly Pond Association and lake residents	June through September
2012	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Trained Pearly Pond Association divers or contracted divers	June through September

Year	Treatment Type	Responsible Party	Schedule
	Installation of benthic barriers, as may be appropriate	DES and Pearly Pond divers	July/August
	Weed Watching and Lake Hosting Activities	Pearly Pond Association and lake residents	June through September
	Site assessment and remapping of variable milfoil infestation	DES	August/September
2013	Update and revise Long-Term Variable Milfoil Control Plan	NH DES, F&G, and interested parties	Spring 2012

- Approximately 42.5 acres of the waterbody will be targeted for herbicide treatment (approximately 30% of the surface area of the pond).

- The Department of Agriculture will impose standard short-term use restrictions for specified days depending on the use (irrigation, contact, etc) and the herbicide used. The shoreline will be posted and public notice will be made.

- By recommending follow-up management practices that utilize integrated plant management strategies such as benthic barrier placement and hand-pulling re-growth, variable milfoil re-growth or population expansion can be slowed. The lake association is interested in providing diver support for this project.

- Based on the types of native plants that are mixed in with the stands of variable milfoil (Figure 2) where herbicide application is recommended there are no significant impacts to native plant communities. It is expected that a well distributed stand of native aquatic plants will remain following herbicide application.

- It is important to realize that aquatic herbicide applications are conducted in a specific and scientific manner, and that the herbicides that are used can be target-specific when used at appropriate doses/concentrations: this means that the invasive plant can be removed and native plants favored in this type of control practice. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

- Because this is a natural system that is being evaluated for management, it is impossible to accurately predict a management course over five years that could be heavily dependent on uncontrolled natural circumstances (weather patterns, temperature, etc). This management plan should be considered a dynamic document that is geared to the actual field conditions that present themselves in this waterbody. If circumstances arise that require the modification of part or all of the recommendations outline here, all interested parties will be consulted for their input on revisions that may be needed to further the goal of variable milfoil management in the subject waterbody.

Figure 1- Map of Variable Milfoil Infestation

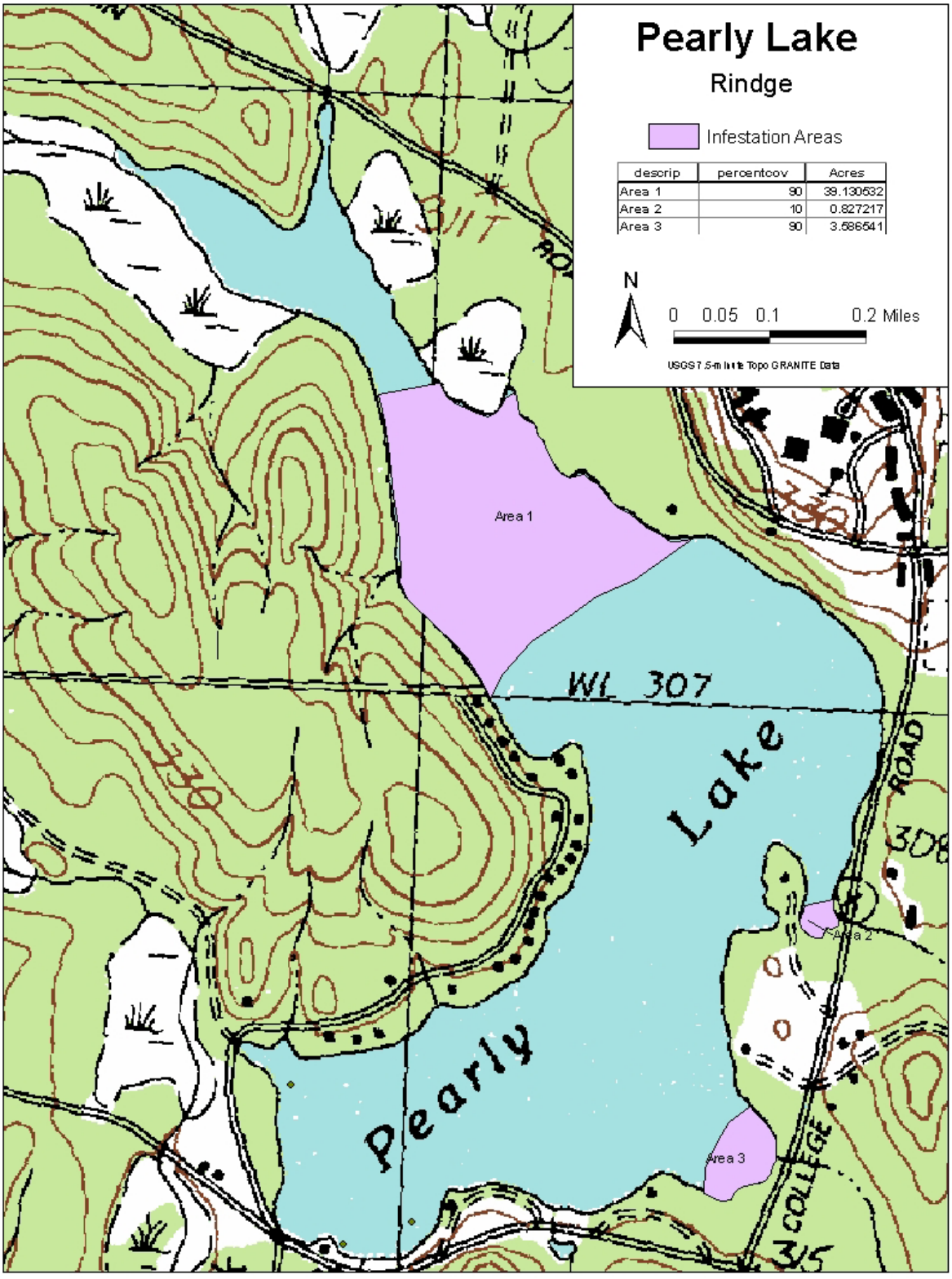
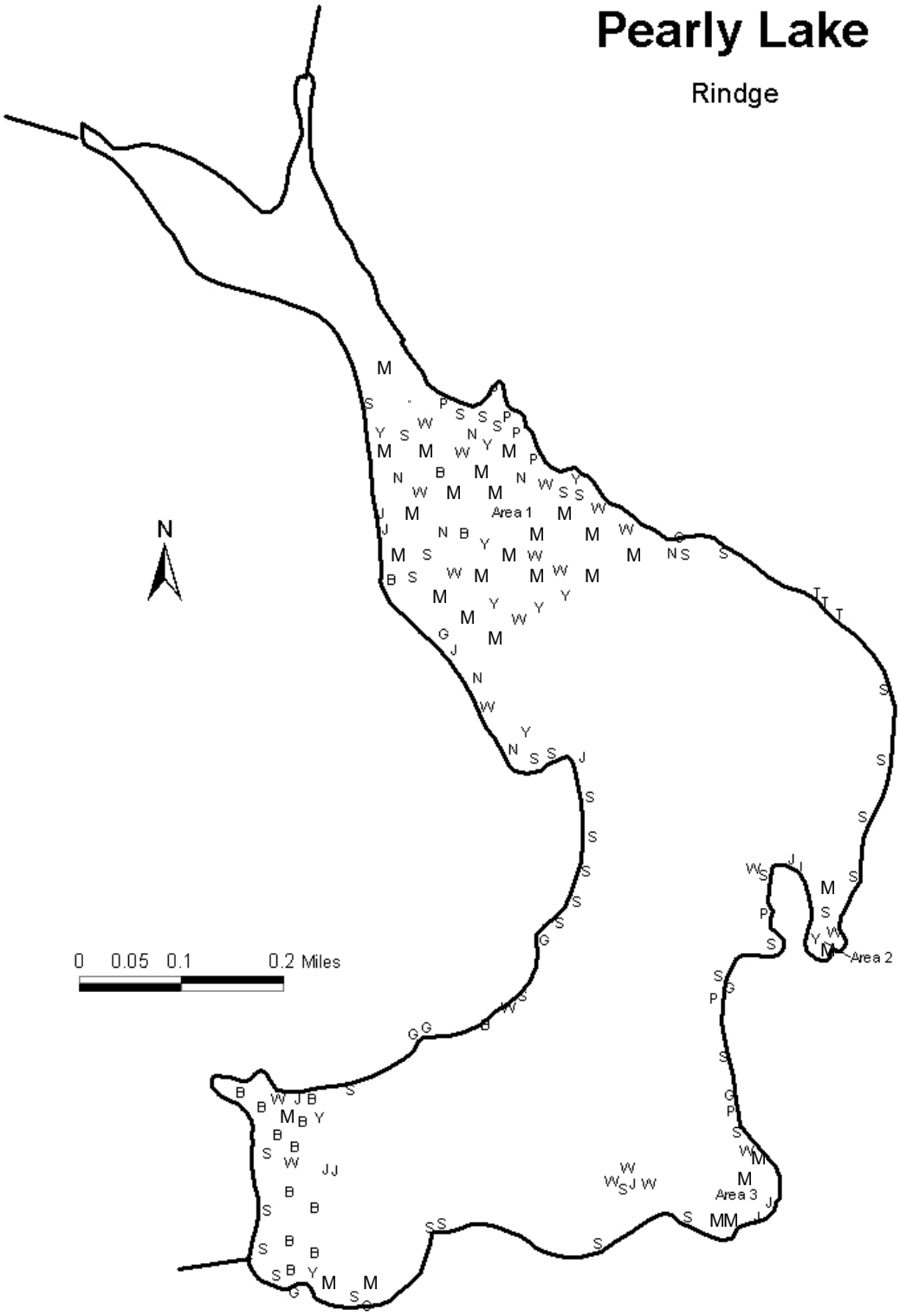

Pearly Lake
Rindge
Infestation Areas
descrip | percentcov | Acres
Area 1 | 90 | 39.130532
Area 2 | 10 | 0.827217
Area 3 | 90 | 3.586541
N
0 0.05 0.1 0.2 Miles
USGS 7.5-minute Topo GRANITE Data
Area 1
WI 307
Pearly Lake
Area 2
Area 3
COLLEGE ROAD

Figure 2- Aquatic Vegetation Map and Key for Pearly Pond, Rindge



Symbol	Common Name	Latin Name
S	Bur-reed	*Sparganium*
T	Cattail	*Typha*
P	Pickerelweed	*Pontedaria cordata*
J	Unknown common name	*Juncus*
M	Variable milfoil	*Myriophyllum heterophyllum*
N	White water-lily	*Nymphaea*
W	Pondweed sp.	*Potamogeton sp.*
Y	Yellow water-lily	*Nuphar*
B	Watershield	*Brasenia schreberi*
G	Grasses	*Unknown genus/species*

Figure 3- Bathymetric Map of Pearly Pond, Rindge

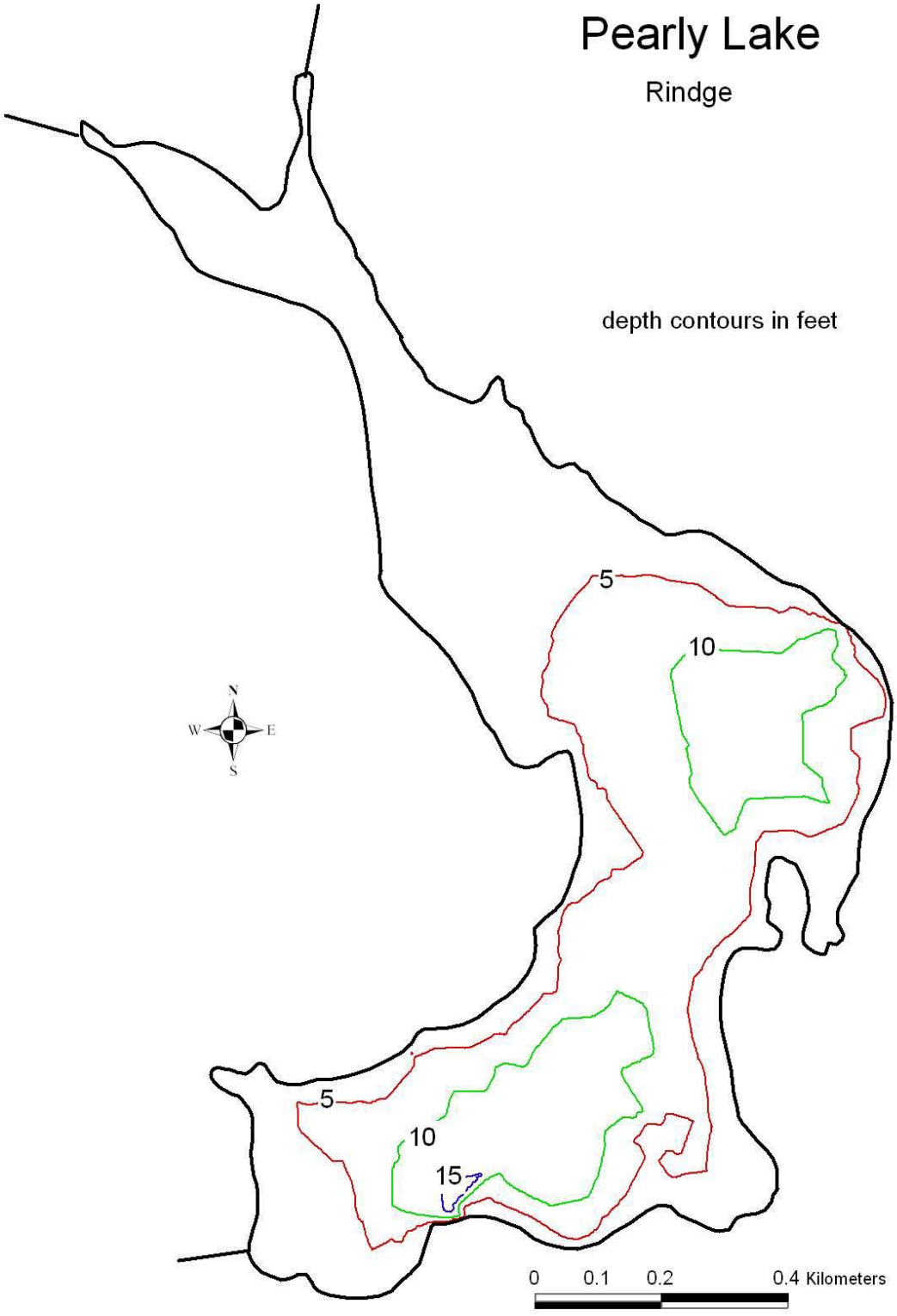


Figure 4- Common Fishing Locations

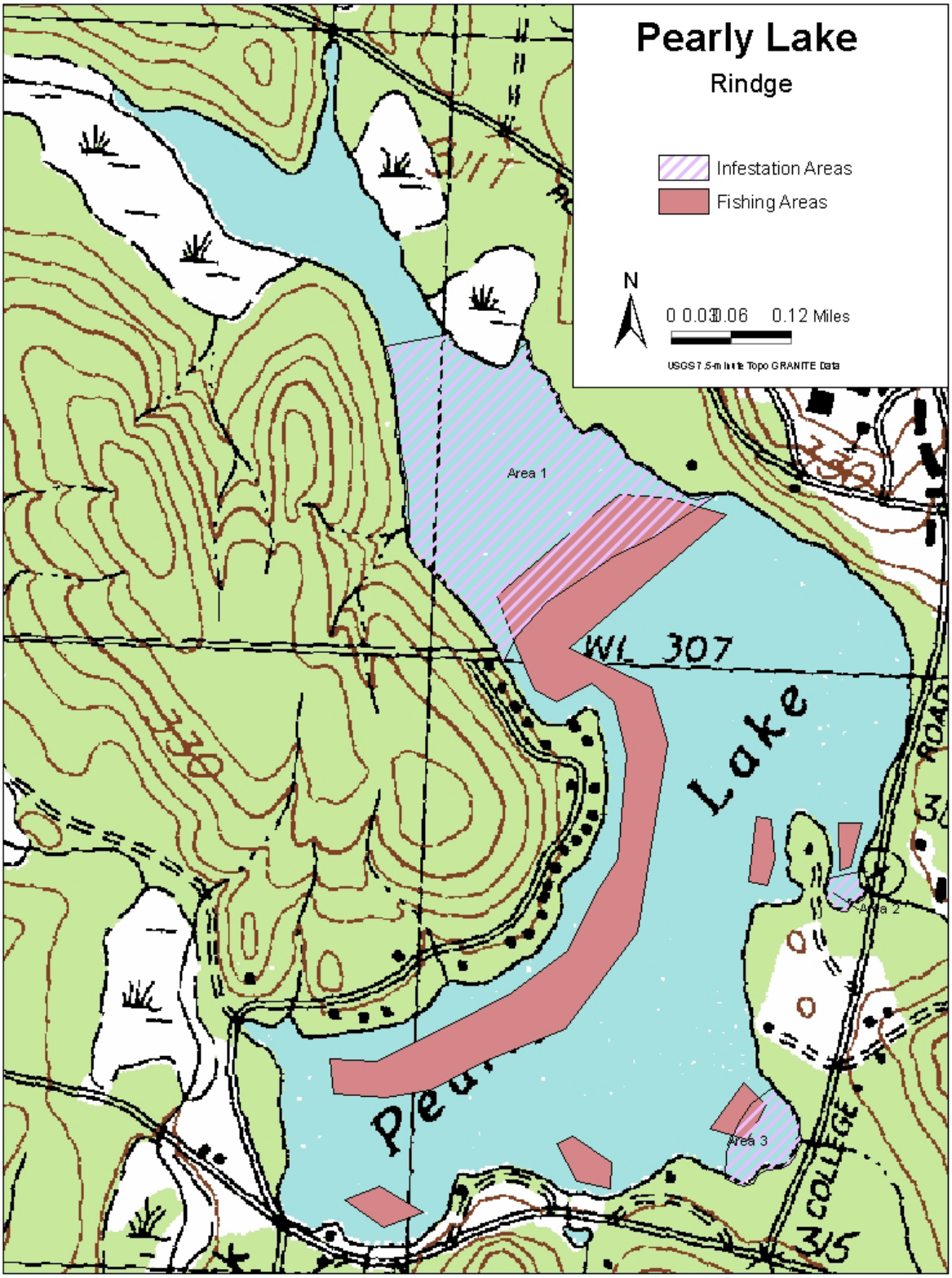


Figure 5- Boat Paths

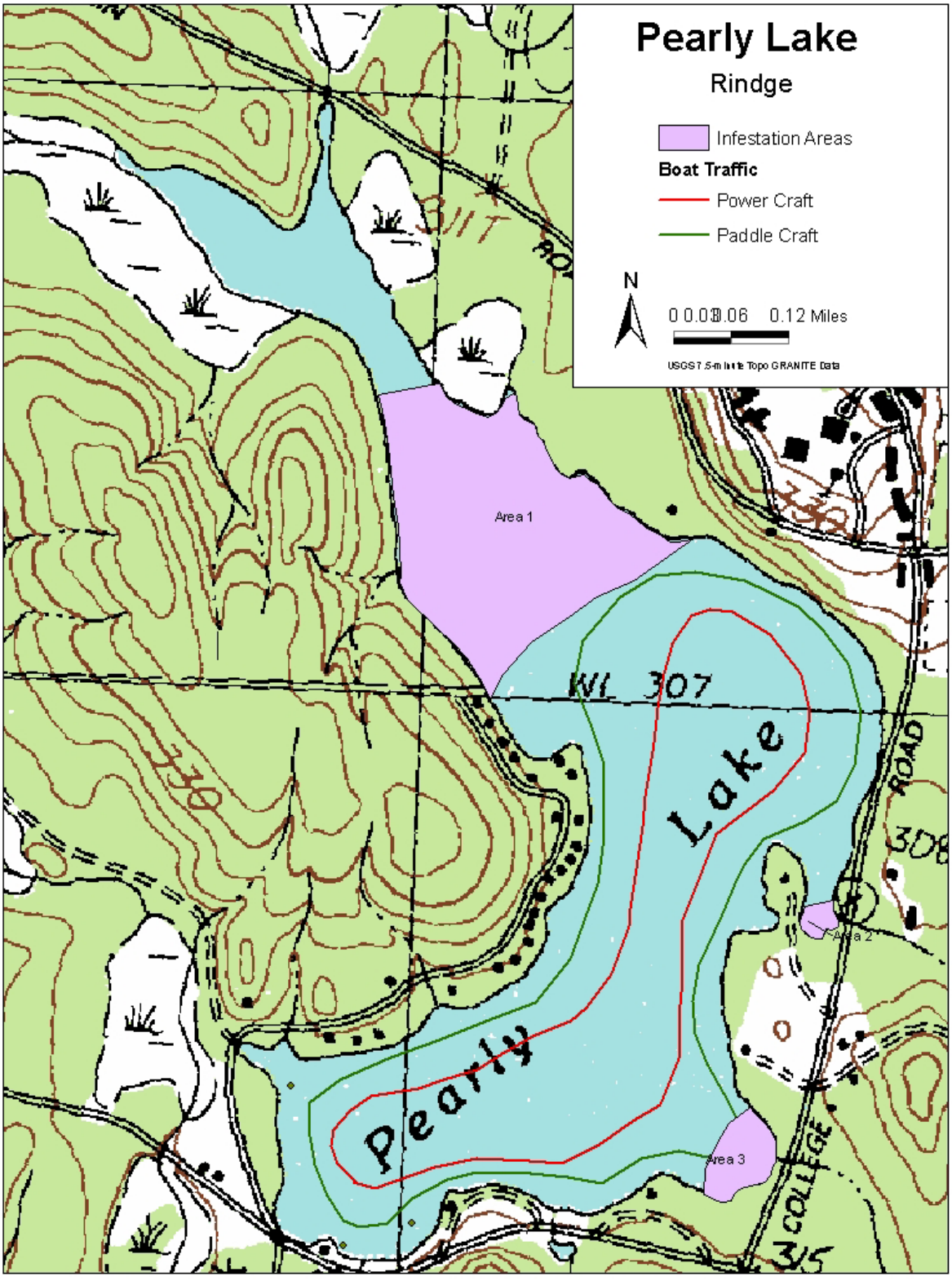
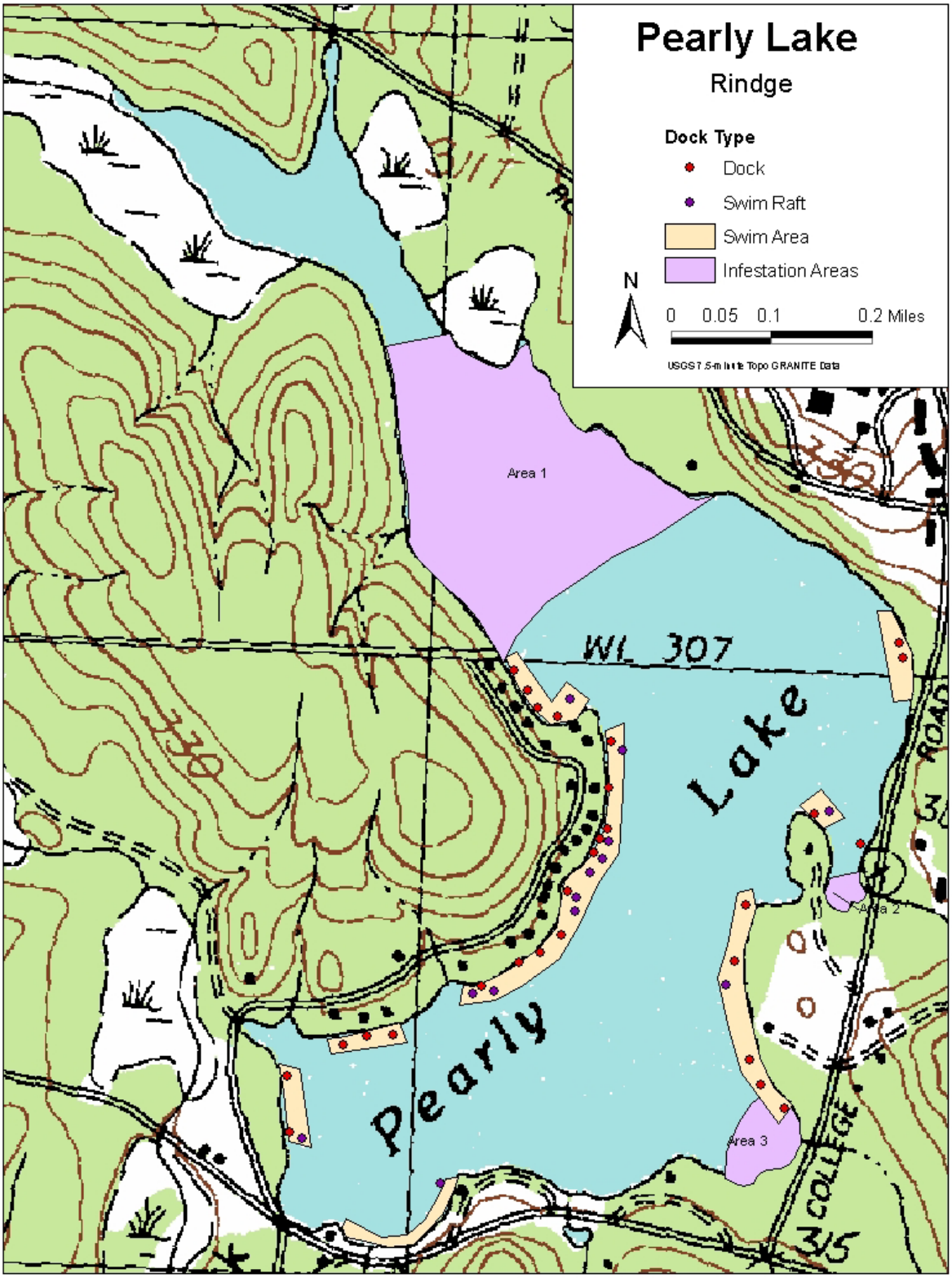


Figure 6- Swim Beaches, Docks, Swim Platforms



APPENDIX A

Criteria to Evaluate the Selection of
Aquatic Plant Control Techniques
NH Department of Environmental Services
Water Division
Preliminary Investigations

I. Field Site Inspection

- Verify genus and species of the plant.
- Determine if the plant is a native or exotic species per RSA 487:16, II.
- Map extent of the plant infestation (area, water depth, height of the plant, density of the population).
- Document any native plant abundances and community structure around and dispersed within the exotic/nuisance plant population.

II. Office/Laboratory Research of Waterbody Characteristics

- Contact the appropriate agencies to determine the presence of rare or endangered species in the waterbody or its prime wetlands.
- Determine the basic relevant limnological characteristics of the waterbody (size, bathymetry, flushing rate, nutrient levels, trophic status, and type and extent of adjacent wetlands).
- Determine the potential impacts to downstream waterbodies based on limnological characteristics (water chemistry, quantity, quality).

Determination of Control Practice Based on Preliminary Investigations

Following are a series of control techniques which have been used in New Hampshire in the past, as well as some techniques which are still experimental. The most appropriate technique based on the determinations of the preliminary investigation should be selected. Applicable statutes are included at the end of this report, along with a copy of the Exotic Species Rules adopted September 5, 1998. These are the guidelines which were used to develop the criteria for the selection of a control technique.

Guidelines and requirements of each control practice are detailed below each alternative. A field sheet should be used in conjunction with this list to document the decision making process.

A. Hand-Pulling

- Can be used for exotic or native species.
- Can be used if infestation is in a small localized area.
- Can be used if plant density is low, or if target plant is scattered and not dense.

- Can be used if the plant could effectively be managed or eradicated by hand-pulling a few scattered plants.
- Use must be in compliance with the Wetlands Bureau rules.

B. Mechanically Harvest or Hydro-Rake

- Can not be used on plants which reproduce vegetatively by fragmentation (e.g., variable milfoil, fanwort, etc.) unless containment can be ensured.
- Can be used only if the waterbody is accessible to machinery.
- Can be used if there is a disposal location available for harvested plant materials.
- Can be used if plant depth is conducive to harvesting capabilities (~ <7 ft. for mower, ~ <12 ft. for hydro-rake).
- Funds are available for repeated harvesting activities in that season.
- A navigation channel is required through dense plant growth.

C. Chemical Treatment

- Can be used if application of chemical is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or type of plant.
- Can be used for treatment of exotic plants where fragmentation is a high concern.
- Can be used where species specific treatment is necessary due to the need to manage other plants (rare or endangered that will not be impacted by chemical treatment).
- Can be used if other methods used as first choices in the past have not been effective.
- A licensed applicator should be contacted to inspect the site and make recommendations about the effectiveness of chemical treatment as compared with other treatments.

D. Restricted Use Areas (per RSA 487:17, II (d))

- Can be used for exotic species only.
- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other activities may cause fragmentation to occur.
- Can not be used when there are several “patches” of an infestation of exotic aquatic plants throughout a waterbody.
- Can be used as a temporary means of control.

E. Bottom Barrier

- Can be used for exotic or native species.

- Can be used in small areas, preferably less than 10,000 sq. ft.

- Can be used in an area where the current is not likely to cause the displacement of the barrier.
- Can be used early in the season before the plant reaches the surface of the water.
- Can be used in an area to compress plants to allow for clear passage of boat traffic.
- Can be used in an area to compress plants to allow for a clear swimming area.

F. Drawdown

- Can be used if the target plant(s) are susceptible to drawdown control.
- Can be used in an area where bathymetry of the waterbody would be conducive to an adequate level of drawdown to control plant growth, but where extensive deep habits exist for the maintenance of aquatic life such as fish and amphibians.
- Can be used where plants are growing exclusively in shallow waters where a drawdown would leave this area "in the dry" for a suitable period of time (over winter months) to control plant growth.
- Can be used in winter months to avoid encroachment of terrestrial plants into the aquatic system.
- Can be used if it will not significantly impact adjacent or downstream wetland habitats.
- Can be used if spring recharge is sufficient to refill the lake in the spring.
- Can be used in an area where shallow wells would not be significantly impacted.
- Reference RSA211:11 with regards to drawdown statutes.

G. Dredge

- Can be used in conjunction with a scheduled drawdown.
- Can be used if a drawdown is not scheduled, though a hydraulic pumping dredge should be used.
- Can only be used as a last alternative due to the detrimental impacts to environmental and aesthetic values of the waterbody.

H. Biological Control

- Grass carp cannot be used.
- Exotic controls, such as insects, cannot be introduced to control a nuisance plant.
- Research should be conducted on a potential biological control prior to use to determine the extent of host specificity.

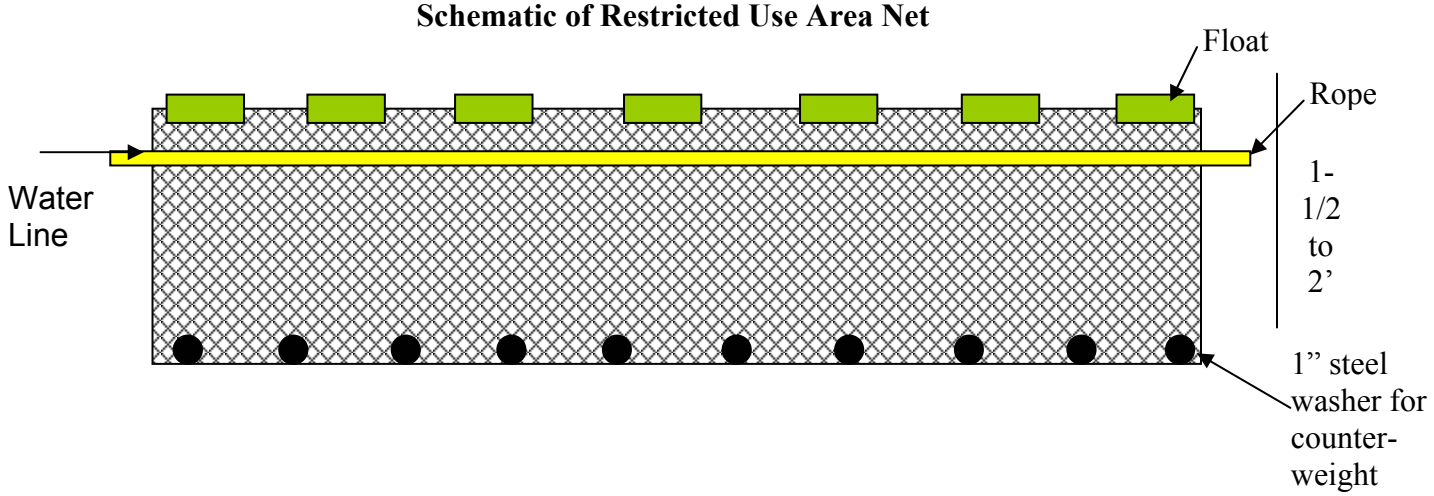
APPENDIX B

SUMMARY OF CONTROL PRACTICES USED IN THE STATE OF NEW HAMPSHIRE FOR EXOTIC AQUATIC PLANTS

Restricted Use Areas:

Restricted Use Areas (RUAs) are a regular control option for lakes with small, contained infestations of exotic plants, limited to small patches or embayments. This is often the case in waterbodies with newly-discovered infestations. RUAs restrict access to all recreational activities in a delineated area to minimize plant fragmentation and thereby reduce the spread of variable milfoil. As an additional method of protection from fragment migration, RUAs are encircled with a shallow net that is suspended vertically in the water column. The net is approximately 1.5-2.0 feet in height. The top of the net is set to extend four inches above the surface of the water, while the remainder is positioned below the surface of the water (see figure below). This configuration prevents the movement of fragments from infested areas to uninfested areas. Due to the size and nature of net construction, there is no impediment to fish migratory patterns or spawning activities.

Schematic of Restricted Use Area Net



Hand-pulling:

When infestations of exotic aquatic plants begin as single scattered stems or small patches, DES biologists SCUBA dive to hand-pull the plants (and DES can train other certified divers to also perform this management practice).

The whole plant including the roots should be removed in this process, while leaving the beneficial native species intact. This technique works best in softer sediments, with shallow rooted species and for smaller, scattered infestation areas. When hand pulling nuisance species, the entire root system and all fragments of the plants must be collected since small root or stem fragments could result in additional growth of the species. The process must be repeated often to control re-growth of the exotic plants. For a new infestation, hand-pulling activities are typically conducted several times during the first season, with follow-up inspections for the next 2-5 years or until no re-growth is observed.

This control practice has proven successful in many waterbodies.

Mechanical Harvesting

The process of mechanical harvesting is conducted by using machines which cut and collect aquatic plants. These machines can cut the plants up to twelve feet below the water surface. The weeds are cut and then collected by the harvester or other separate conveyer-belt driven device where they are stored in the harvester or barge, and then transferred to an upland site.

The advantages of this type of weed control are that cutting and harvesting immediately opens an area such as boat lanes, and it removes the upper portion of the plants. Due to the size of the equipment, mechanical harvesting is limited to water areas of sufficient size and depth. It is important to remember that mechanical harvesting can leaves plant fragments in the water, which if not collected, may spread the plant to new areas. Additionally harvesters may impact fish and insect populations in the area by removing them in harvested material. Cutting plant stems too close to the bottom can result in re-suspension of bottom sediments and nutrients. This management option is only recommended when nearly the entire waterbody is infested, and harvesting is needed to open navigation channels through the infested areas.

Benthic Barriers:

When a small infestation of exotic aquatic plants occurs in clusters of growth (generally areas >5 ft^2), as opposed to scattered stems, a permeable fiberglass screen can be placed over the area of infested lake sediments. The permeable fabric screening allows for gas release from the sediments while effectively blocking sunlight and compressing the plants into the sediment, inhibiting photosynthesis and eventually killing the plant. Occasionally, in some lakes, gas release from the sediments or boating activity cause the uplifting of screening. Benthic barriers can effectively control small infestations of less than approximately 1000 square feet.

Benthic barriers have two basic applications. These practices are used to cover pioneering infestations and prevent the spread of the plant. Bottom barriers are installed across small portions of lake bottoms infested with invasive aquatic plants. The disadvantage of benthic barriers is their non-selectivity and limitation of cover to less than 10,000 sq. ft.. Additionally, these physical barriers prevent the growth of all vegetation, which is a necessary component of fish and wildlife habitat.

Bottom barriers are attached to the bottom of a water body by re-bar attached to the edges and across the middle of the material. Bottom barriers are transported to the shoreline adjacent to where installation is to occur. They are then cut to fit the treatment site and rolled onto a length of pipe. Divers carry the roll into the water at the start of the treatment site and secure one edge of the material to the lake bottom. The divers then roll out the remainder of the material and continue to secure it to the bottom sediments. This process is repeated until the plants in the treatment are covered.

Bottom barriers are generally considered for small localized areas rather than lakewide application. Bottom barriers provide 100% control of this weed in areas where they are installed. They also provide long-term control. An ongoing maintenance operation is required to inspect the bottom barrier and clear the mats of sediment buildup.

Benthic barriers are not recommended for application in river systems, as flow can easily uplift the barrier.

Targeted Application of Herbicides:

The use of chemicals, such as herbicides, for the control of noxious and nuisance plant species represents one of the most widely known and effective management options available. Herbicide control of invasive aquatic plants is often the first step in a long-term integrated control program. In the last 15 to 20 years the use and review of herbicides has changed significantly in order to accommodate safety, health, and environmental concerns. Currently no herbicide product can be labeled for aquatic use if it has more than a one in a million chance of causing significant harmful effects to human health, wildlife, or the environment. Because of this, the number of effective and U.S. Environmental Protection Agency (EPA) approved herbicides for aquatic weeds are limited. In most cases the cost and time of testing and registration, rather than environmental issues, limits the number of potentially effective compounds.

All herbicide applications in New Hampshire are performed under permits issued by the New Hampshire Department of Agriculture, Division of Markets and Food, Bureau of Pesticide Control.

Two herbicides have been used in New Hampshire for the control of variable milfoil. Diquat (trade name Reward), the most often-used herbicide, is a contact herbicide that can generally provide one season of control for variable milfoil. Because this herbicide does not target the root systems, the plants eventually re-grow from established roots.

The second herbicide, 2, 4-D (trade name Navigate), is a systemic herbicide. It is absorbed into the sediments and taken up through the root system, killing both the roots and the plant biomass above the sediments. Label restrictions for aquatic application currently limit its use in New Hampshire to waterbodies with no water intakes, and with no wells adjacent to the shoreline.

The aquatic herbicide SONAR has been used in New Hampshire to control growths of fanwort. The chemical acts by limiting photosynthesis when chlorophyll-a is affected by the active ingredient of the herbicide.

Extended Drawdown

Water drawdown is used for control of some species of aquatic macrophytes. Drawdown requires some type of mechanism to lower water levels, such as dams or water control structures and use is thus limited. It is most effective when the drawdown depth exceeds the depth or invasion level of the target plant species.

In northern areas, drawdown will result in plant and root freezing during the winter for an added degree of control. Drawdown is typically inexpensive and has intermediate effects (2 or more years). However, drawdown can have other environmental effects and interfere with other functions of the water body (e.g. drinking water, recreation, or aesthetics). Drawdown can result in the rapid spread of highly opportunistic annual weed species, which in most cases is the plant that is targeted for control.

Drawdowns have been used in the past for plant control. In theory, the drying of the plants in the summer, or the freezing of the plants in the winter, will eliminate or limit plant growth. However, variable milfoil often forms a more succulent terrestrial form during drawdown conditions and the succulent form of the plant can remain viable for long periods of time without submergence, making the practice ineffective. This strategy can be used for control of some native plant species.

Dredging

Dredging is a means of physical removal of aquatic plants from the bottom sediments using a floating or land-based dredge. Dredging can create a variety of depth gradients creating multiple plant environments allowing for greater diversity in lakes plant, fish, and wildlife communities. However due to the cost, potential environmental effects, and the problem of sediment disposal, dredging is rarely used for control of aquatic vegetation alone.

Dredging can take place in to fashion, including drawdown followed by mechanical dredging using an excavator, or using a diver-operated suction dredge while the water level remains up.

Biological Control:

There are no approved biological controls for submersed exotic aquatic plant at that time in New Hampshire.